



OPEN ACCESS

Key Words

Diabetic foot ulcer, chronic ulcer, demographic profile, diabetes mellitus, trauma-induced ulcer, peripheral neuropathy

Corresponding Author

Dr. Kaushal Shetty,
Department of General Surgery
Srinivas Institute of Medical Sciences
and Research Centre, Mangalore,
India

Author Designation

^{1,2,4}Assistant Professor

³Associate Professor

Received: 20 November 2024

Accepted: 15 December 2024

Published: 31 December 2024

Citation: Dr. Souvik Patra, Dr. Rakshith M. Shetty, Dr. Pranup Roshan Quadras and Dr. Kaushal Shetty, 2024. Clinical and Demographic Profile of Diabetic Foot Ulcers: Insights from a Hospital-Based Observational Study. Res. J. Med. Sci., 18: 673-676, doi: 10.36478/makrjms.2024.12.673.676

Copy Right: MAK HILL Publications

Clinical and Demographic Profile of Diabetic Foot Ulcers: Insights from a Hospital-Based Observational Study

¹Dr. Souvik Patra, ²Dr. Rakshith M. Shetty, ³Dr. Pranup Roshan Quadras and ⁴Dr. Kaushal Shetty

¹Department of General Surgery, ICARE Institute of Medical Sciences and Research and Dr B C Roy Hospital, Haldia, West Bengal, India

²Department of General Surgery, A.J Institute of Medical Sciences and Research Centre, Mangalore, India

³Department of Anatomy, A.J Institute of Medical Sciences and Research Centre, Mangalore, India

⁴Department of General Surgery, Srinivas Institute of Medical Sciences and Research Centre, Mangalore, India

ABSTRACT

Diabetic foot ulcers (DFUs) are among the most severe complications of diabetes mellitus, contributing significantly to patient morbidity, mortality and healthcare costs. This study aimed to evaluate the clinical and demographic characteristics of patients with DFUs in a tertiary care center. A hospital-based observational study was conducted at I care Institute of Medical Sciences and Research and BC Roy Hospital. A total of 136 diabetic patients with foot ulcers were included. Data on demographic and clinical parameters, including age, gender, site of residence, duration of diabetes and ulcer characteristics, were collected. Standardized treatment protocols were followed and outcomes were analyzed using descriptive statistics. The study found that DFUs were more prevalent in males (89.99%) than females (31.44%). The majority of patients were aged 51-60 years (41.07%), with a slightly higher prevalence in rural residents (52.68%). The plantar aspect of the foot was the most common ulcer site (46.43%), followed by the dorsum of the foot (38.39%). Chronic ulcers (80.36%) and traumatic onset (68.38%) were predominant. Most patients had diabetes for 1-10 years, highlighting the association between disease duration and DFU risk. This study underscores the demographic and clinical burden of DFUs, emphasizing the need for early detection, effective management and targeted prevention strategies. The findings align with global trends, demonstrating the critical role of peripheral neuropathy, trauma and delayed care in ulcer development and chronicity.

INTRODUCTION

The global prevalence of type 2 diabetes is rising rapidly, attributed primarily to sedentary lifestyles and obesity. In 2000, the worldwide incidence of diabetes was estimated at 171 million, a figure projected to triple by 2030, making it one of the most pressing global health concerns of the 21st century^[1-3]. Among the complications associated with diabetes, diabetic foot ulcer (DFU) is one of the most severe, affecting approximately 15% of diabetic patients and contributing to 84% of lower-limb amputations^[4,5]. DFU commonly develops as a result of trauma or infection, especially in areas with compromised vascularity due to diabetes. Despite insulin therapy and controlled diets, nearly 15% of diabetic patients experience non-healing ulcers, often necessitating amputation. The underlying pathophysiology of DFU includes prolonged inflammatory phases of wound healing caused by hyperglycemia, diabetic microangiopathy and reduced oxygen utilization due to glycosylated hemoglobin and tissue proteins^[4,5]. Peripheral vascular disease, driven by atherosclerosis, plays a critical role in DFU development. The diffuse, calcified nature of atherosclerosis in diabetic patients increases vascular stiffness, further complicating healing^[4]. Additionally, diabetic neuropathy often delays medical intervention due to the masking of pain, leading to infection and worsening ulceration. Diagnosis of DFU relies on clinical evaluations and imaging techniques such as pulse measurements, ankle-brachial index, Doppler ultrasound and advanced imaging modalities like CT angiography and MR angiography^[6-10]. While recent advancements have introduced innovative diagnostic and therapeutic approaches, effective management of DFU remains a challenge. Studies indicate that offloading techniques play a significant role in reducing plantar pressure and enhancing healing, highlighting the need for accessible, cost-effective treatment options^[5,10]. This study aims to compare the efficacy of the Mandakini offloading technique with conventional normal saline dressing in the management of DFU. The Mandakini technique has shown promise in decreasing plantar pressure and pain, providing a simple and economical solution for DFU management^[10].

MATERIALS AND METHODS

Study Design and Setting: This hospital-based observational study was conducted in the Department of General Surgery at Icare Institute of Medical Sciences and Research and BC Roy Hospital, Haldia, West Bengal, over a period of 3 years, from September 2021 to March 2024.

Study Population: Sample size was calculated considering a 26% of diabetic patients who experienced a reduction in pain with gauze dressing. To detect a clinically significant difference of 34% in

pain reduction with a confidence level of 95% and a power of 80%, the sample size required for each group was calculated to be 53 participants. The study included 136 patients diagnosed with diabetic foot ulcers. After accounting for an anticipated dropout rate of 20%, the total sample size was adjusted to 136 participants. Participants were recruited using a purposive sampling technique, ensuring that only individuals meeting the inclusion criteria were included.

Inclusion and Exclusion Criteria: The study included diabetic patients aged 18 years and older, with ulcers measuring more than one centimeter and controlled blood glucose levels. Patients with absent peripheral pulses, evidence of osteomyelitis on X-ray, malnutrition, uncontrolled diabetes, or those unwilling to participate were excluded from the study.

Data Collection: Demographic and clinical characteristics of the patients were recorded, including age, gender, site of residence, side of involvement, site of presenting lesion, type of onset, duration of diabetes, duration of the ulcer and presence of co-morbidities. The site of the lesion was categorized into dorsum of the foot, great toe, heel and plantar aspect of the foot. Onset of lesions was recorded as either spontaneous or traumatic. The duration of diabetes was classified into less than one year, 1-5 years, 6-10 years, 11-15 years and >15 years. The ulcer duration was categorized as acute or chronic.

Intervention: A standardized treatment protocol was followed for all patients, which included routine care for diabetic foot ulcers. Dressing methods were employed based on clinical judgment, but no specific group interventions were compared in this study. The focus was on observing patient characteristics and outcomes under uniform care protocols.

Statistical Analysis: Data were analyzed using descriptive statistics. Quantitative variables such as age and duration of diabetes were summarized using means and percentages, while qualitative variables like site of lesion and type of onset were expressed in proportions. No comparative statistical tests were applied as the study was observational without predefined groups or interventions being compared. This methodological framework ensured a systematic evaluation of the demographic and clinical profile of patients presenting with diabetic foot ulcers.

Statistical Analysis: Qualitative data were represented as percentages, while descriptive data, including mean, range and standard deviation, were used to describe quantitative variables. The Z-test was employed to assess significant differences between the two groups in terms of pain reduction, hospital stay duration,

number of dressings required and plantar pressure outcomes. This approach ensured a robust comparison of the effectiveness of the two treatment modalities^[10].

RESULTS AND DISCUSSIONS

Demographic Profile: A total of 136 participants were included in our study. In the present study 31-40 years we had 5 patients (3.57%), 41-50 years we had 28 patients (20.54%), 51-60 years we had 56 patients (41.07%), 61-70 years we had 38 patients (27.68%) and more than 70 years we had 10 patients (7.14%). Males in the study were 101 (89.99%) and number of females were 35 (31.44%). Number of patients residing in urban area were 53 (47.32%) and rural area were 59 (52.68%).

Clinical Profile: Number of patients with right side involvement were 97 (86.61%) and left side involvement were 39 (34.82%). (Table 1) shows that the site of presenting lesion was dorsum of foot in 43 patients (38.39%), great toe in 22 patients (19.64%), heel in 19 patients (16.96%) and plantar aspect of foot in 52 patients (46.43%).

Table 1. Site of Presenting Lesion

| Site of the Presenting Lesion | Case no | Percentage |
|-------------------------------|---------|------------|
| Dorsum foot | 43 | 38.39% |
| Great toe | 22 | 19.64% |
| Heel | 19 | 16.96% |
| Foot Plantar | 52 | 46.43% |
| Total | 0 | 0.00% |

(Table 2) shows the duration of DM was <1 year in 9 patients (6.25%), 1-5 years in 51 patients (37.50%), 6-10 years in 47 patients (34.82%), 11-15 years in 22 patients (16.07%) and more than 15 years in 7 patients (5.36%). Acute lesions were seen in 27 patients (19.64%) and chronic lesions in 109 patients. (80.36%). Onset was spontaneous in 43 patients (31.62%) and traumatic in 93 patients. (68.38%).

Table 2. Duration of Diabetes Mellitus

| Duration of DM | Case no | Percentage |
|----------------|---------|------------|
| <1 Year | 9 | 6.25% |
| 1-5 Years | 51 | 37.50% |
| 6-10 Years | 47 | 34.82% |
| 11-15 Years | 22 | 16.07% |
| <15 Years | 7 | 5.36% |
| Total | 136 | 100.00% |

Diabetes mellitus is the major healthcare problem worldwide. Diabetes mellitus, the most common endocrine disorder is characterized by metabolic abnormalities due to relative or absolute deficiency of insulin or insulin resistance resulting in hyperglycemia and associated with micro and microvascular complications. In a developing country like India that is nick named as the diabetic capital of the world there are several diabetics who suffer from wound related complications adding to the economic burden they

face. The real burden of the disease is however due to its associated complications which lead to increased morbidity and mortality.

Demographic Profile: In the study the number of males in the study were 101 (89.99%) and number of females were 35 (31.44%). Overall male had a higher incidence of diabetic ulcers this is statistically significant with a p value 0.002. This is comparable with study by Ashwath^[11] 82 (68.3%) were males and remaining 38 (31.7%) were females. Shiva Kumar^[12] noted that the 81 were male and 19 females. Ashwath^[11] noted that the mean age in my study population was 50.12±12.88 years. Among the total 120 cases, 10 (8.3%) were <40 years of age. 17 (14.2%) were 41-50 yrs. 27 (22.5%) were 51-60 years. 43 (35.8%) were 61-70 years and the remaining 23 (19.2%) were >70 years.

Clinical Profile: Most lesions were located on the plantar aspect of the foot (46.43%), followed by the dorsum of the foot (38.39%). Chronic lesions were significantly more common (80.36%) than acute lesions (19.64%). The majority of DFU cases were traumatic in origin (68.38%). The predominance of plantar ulcers is corroborated by studies like that of Pemayun^[13], which highlighted the plantar aspect as a high-pressure zone, often leading to ulcer formation in diabetic patients. Similarly, the higher incidence of chronic lesions reflects findings in global studies where delays in seeking medical care often result in chronic ulceration. Plantar ulcers are common due to their association with increased weight-bearing and pressure points in diabetic neuropathy. The high percentage of chronic ulcers may be due to delayed diagnosis and limited access to specialized care, particularly in rural settings.

Duration of Diabetes: Most patients had been diagnosed with diabetes for 1-5 years (37.50%) or 6-10 years (34.82%), highlighting an association between the duration of diabetes and DFU development. This pattern aligns with the findings of Lavery *et al.*, who demonstrated a higher risk of DFUs among patients with a longer duration of diabetes, particularly beyond five years^[14]. The progressive nature of diabetes-related complications, including neuropathy and peripheral vascular disease, explains the increased prevalence of DFUs with longer disease duration.

Onset of Ulcers: Trauma was the most common cause of ulcer onset, accounting for 68.38% of cases. Traumatic onset as the primary cause of DFUs has been widely reported, with studies like those by Armstrong *et al.* attributing trauma to the lack of protective sensation in diabetic neuropathy patients^[15,16]. The role of peripheral neuropathy in predisposing patients to unnoticed trauma, combined with poor footwear

practices, particularly in rural areas, may explain the high proportion of trauma-related ulcers in this study.

CONCLUSION

This study highlights the significant burden of diabetic foot ulcers (DFUs) in patients with diabetes mellitus, particularly among males and those aged 51-60 years. The findings emphasize the prevalence of chronic and trauma-induced ulcers, predominantly located on the plantar aspect of the foot and their association with longer durations of diabetes. These results underscore the critical need for early diagnosis, patient education, and preventive measures to reduce the risk of ulceration and its complications. The higher prevalence of DFUs in rural areas and the predominance of trauma as a triggering factor point to the necessity of improving healthcare access, promoting protective footwear and implementing regular foot care practices, especially in under served populations. Effective management strategies should focus on addressing modifiable risk factors, such as delayed care and unawareness of proper diabetic foot care, to mitigate the economic and social impact of this debilitating condition. Further research is recommended to evaluate long-term outcomes of various treatment modalities and their cost-effectiveness, particularly in resource-constrained settings. A comprehensive approach involving clinicians, care givers and policymakers is essential to combat the growing burden of DFUs and improve quality of life for individuals with diabetes.

Conflict of Interest: None.

REFERENCES

1. Mellitus, D., 2005. Diagnosis and classification of diabetes mellitus. *Diabetes care.*, 28: 5-10.
2. Alam, U., O. Asghar, S. Azmi and R.A. Malik, 2014. General aspects of diabetes mellitus. *Handbook Clin. Neurol.*, 126: 211-222.
3. Lakhtakia, R., 2013. The History of Diabetes Mellitus Sultan Qaboos Uni. *Med. J.*, Vol. 13 .10.12816/0003257.
4. Tripathi, B.K. and A.K. Srivastava., 2006. Diabetes mellitus: complications and therapeutics. *Medical science monitor.*, 12: 130-147.
5. Nathan, D.M., 1993. Long-Term Complications of Diabetes Mellitus. *New Engl. J. Med.*, 328: 1676-1685.
6. Lotfy, M., J. Adeghate, H. Kalasz, J. Singh and E. Adeghate, 2017. Chronic Complications of Diabetes Mellitus: A Mini Review. *Curr. Diabetes Rev.*, 13: 3-10.
7. Syafril, S., 2018. Pathophysiology diabetic foot ulcer. *IOP Conf. Ser.: Earth Environ. Sci.*, Vol. 125 .10.1088/1755-1315/125/1/012161.
8. Ugwu, E., O. Adeleye, I. Gezawa, I. Okpe, M. Enamino and I. Ezeani, 2019. Predictors of lower extremity amputation in patients with diabetic foot ulcer: Findings from MEDFUN, a multi-center observational study. *J. Foot Ankle Res.*, 12: 1-8.
9. Hicks, C.W., J.K. Canner, N. Mathioudakis, C. Lippincott, R.L. Sherman and C.J. Abularrage, 2020. Incidence and Risk Factors Associated With Ulcer Recurrence Among Patients With Diabetic Foot Ulcers Treated in a Multidisciplinary Setting. *J. Surg. Res.*, 246: 443-450.
10. Davis, F.M., A. Kimball, A. Boniakowski and K. Gallagher, 2018. Dysfunctional Wound Healing in Diabetic Foot Ulcers: New Crossroads. *Curr. Diabetes Rep.*, 18: 1-8.
11. Xu, F., C. Zhang and D.T. Graves, 2013. Abnormal Cell Responses and Role of TNF- α Impaired Diabetic Wound Healing. *BioMed Res. Int.*, Vol. 2013 .10.1155/2013/754802.
12. S.T., S. Arava, P.M. , G.S. , C.B. and N. M, 2016. Diabetic ulcer severity score: Clinical validation and outcome. *Int. Surg. J.*, 3: 1606-1610.
13. Venkataramana, A.V.H., M.B.D. , A. Razack, H.H.R. and H. Arish, 2020. A prospective study to determine the application of site, ischemia, neuropathy, bacterial infection and depth scoring in the outcome and management of diabetic foot ulcers. *Int. Surg. J.*, 7: 478-483.
14. Pemayun, T.G., R.M. Naibaho, T.G. Mahadewa, D. Lobo and H.G. Johari., 2015. Risk factors for lower extremity amputation in patients with diabetic foot ulcers. *Diabetes Res Clin Pract.*, 110: 210-215.
15. Lavery, L.A., D.G. Armstrong, R.P. Wunderlich, M.J. Mohler, C.S. Wendel and B.A. Lipsky, 2006. Risk Factors for Foot Infections in Individuals With Diabetes. *Diabetes Care*, 29: 1288-1293.
16. Armstrong, D.G., A.J.M. Boulton and S.A. Bus, 2017. Diabetic Foot Ulcers and Their Recurrence. *New Engl. J. Med.*, 376: 2367-2375.